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EXAMINER

VINH, LAN

ART UNIT PAPER NUMBER

1765

DATE MAILED: 01/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/072,160

Applicant(s)

SCHLUPP ET AL.

Examiner

Lan Vinh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 February 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-42 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-9 is/are allowed.
- 6) ☒ Claim(s) 10-33 and 35-42 is/are rejected.
- 7) ☒ Claim(s) 34 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 10-15, 19-20, 24-30, 33, 35-37, 40-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al (US 6,057,207) in view of Parat et al (US 6,194,784)

Lin discloses a method of planarizing a semiconductor substrate. This method comprises the steps of:

forming a multi-layer film stack comprises a second oxide layer 20 disposed above the substrate 10, a second nitride layer 24 disposed above layer layer 20/second oxide layer, an oxide liner/first oxide layer disposed above second nitride layer 24, a first nitride layer 44 disposed above the oxide liner, the multi-layer film stack disposed on first device region 12A separated from second device region 12B by trench 30 (col 4, lines 39-65, col 5, lines 20-21; fig. 2). The trenches are formed by etching (col 1, lines 62-63)

depositing oxide 40 to fill the trenches (col 2, lines 51-54)

polishing down the layer 40/trench oxide (col 50-52)

Unlike the instant claimed invention as per claims 10, 29, Lin fails to disclose depositing a trench oxide/an oxide to fill the trench to cover the first nitride.

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However, Parat discloses a process for forming a gate stack comprises the step of depositing trench oxide layer 221 to cover nitride layer 238/first nitride (col 6, lines 50-52)

Since both Lin and Parat are directed to method of forming gate having stacked layer, one skilled in the art would have found it obvious to modify Lin method by adding the step of depositing trench oxide layer to cover nitride layer as per Parat because according to Parat, following the encapsulation of the stack in silicon nitride etch stop layer, an upper insulative or dielectric layer is preferably formed over/to cover the semiconductor device to create a upper layer (col 6, lines 50-56)

Regarding claims 11, 30, Lin discloses performing a first CMP (chemical mechanical polishing) to polish oxide layer 40 exposing the barrier layer 44/first nitride layer (col 47-49, fig.4)

Regarding claims 12, 37, Lin discloses performing a second CMP (chemical mechanical polishing) to polish oxide layer 40 exposing the second barrier layer 24/second nitride layer (col 7, lines 39-45, fig. 7)

Regarding claims 13-15, 35, Fig. 8 of Lin shows that layer 44/first nitride layer, the liner oxide layer and layer 24/second nitride layer are removed from the semiconductor structure.

Regarding claims 19-20, Lin discloses that the oxide liner/first oxide layer having a thickness of between 200-400 Angstroms (col 5, lines 22-24), which overlaps the claimed range of 100-400 Angstroms.

Regarding claims 24, 27, fig. 2 of Lin shows that first device region 12A is larger than second device region 12B

Regarding claims 25, 26, Fig. 8 of Lin shows that after the first CMP step, the height of the first device region 12A is approximately equal to the height difference between the top of trench oxide 40 and the first edge of first device region 12A, the height of the second device region 12B is approximately equal to the height difference between the top of trench oxide 40 and the first edge of second device region 12B. Lin also discloses that the height difference between the top surface of trench oxide and the top surface of the active regions 12A 12B in a range of 300-700 Angstroms.

Regarding claims 28, 42, Lin discloses forming an oxide liner layer/oxidation layer prior to forming trench oxide 40 (col 5, lines 20-22)

Regarding claims 33, 40-41, Lin discloses the step of removing the nitride layer 44/first nitride (col 7, lines 39-40) and the step of using phosphoric acid to remove nitride layer 24/second nitride layer (col 7, lines 47-48)

Regarding claims 35-36, Lin discloses removing the oxide layer/insulating layer using dry etch (col 7, lines 4-7)

3. Claims 16-17, 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al (US 6,057,207) in view of Parat et al (US 6,194,784) and further in view of Lyons et al (US 5,930,645)

Lin as modified by Parat has been described above in paragraph 2. Unlike the instant claimed inventions as per claims 16-17, 19-22, Lin and Parat do to disclose the specific thickness of the layers.

However, Lyons, in a method of forming trench isolation, teaches that the thickness of a layer depending on the variables of the polishing process (col 6, lines 21-23)

Thus, Lyons serves as evidence that the thickness of a layer is a "result effective variable". It has been held that the discovery of an optimum value for result effective variable is within the purview of routine experimentation by the person of ordinary skilled in the art. In re Boesch, 617 F.2d 272, 276, 205 USPQ 215, 219 (CCPA 1980)

4. Claims 18, 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al (US 6,057,207) in view of Parat et al (US 6,194,784) and further in view of Iyer (US 6,194,305)

Lin as modified by Parat has been described above in paragraph 2. Unlike the instant claimed inventions as per claims 18, 23, Lin and Parat do to disclose forming the nitride layer by PECVD.

However, Iyer discloses a method of planarization comprises the step of forming silicon nitride by PECVD (col 4, lines 10-15)

One skilled in the art would have found it obvious to modify Lin and Parat by forming the nitride layer by PECVD as per Iyer because Iyer states that PECVD is a known process to provide conformal coating of delicate high aspect ratio feature and so are preferably to other methods of thin film formation (col 4, lines 13-17)

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5. Claims 31-32, 38-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin et al (US 6,057,207) in view of Parat et al (US 6,194,784) and further in view of Satoh (US 6,245,642)

Lin as modified by Parat has been described above in paragraph 2. Unlike the instant claimed inventions as per claims 31-32, 38-39, Lin and Parat do to disclose using a slurry includes cerium in the step of polishing the oxide expose the nitride layer.

However, Satoh discloses a process for planarizing semiconductor device comprises the step of polishing the silicon oxide layer using a slurry includes cerium (col 4, lines 29-38)

Since Lin discloses the step of polishing an oxide layer exposing the nitride layer, one skilled in the art would have found it obvious to modify Lin and Parat by polishing the oxide layer using a slurry includes cerium as per Satoh because Satoh teaches that by using a slurry includes cerium the oxide film can be selectively polished while the polishing of the silicon oxide film is suppressed (col 4, lines 39-42)

Allowable Subject Matter

6. Claims 1-9 are allowed.

Claim 34 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is an examiner's statement of reasons for allowance:

Regarding claim 1, the applicants have presented a persuasive argument that the cited prior art of record fails to disclose the step of performing a first polish, said first polish comprising polishing an oxide that fill one or more trenches to the level of a first polish stop layer of a multi-film stack. The closest cited prior art of Lin et al (US 6,057,207) disclose the step of performing a first polish, said first polish comprising polishing an oxide 40 that fill one or more trenches 30 to a level above the level of a etch barrier layer 44/polish stop layer of a multi-film stack.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 34, the applicants have presented a persuasive argument that the cited prior art of record fails to disclose the step of removing the first nitride layer using hot phosphoric acid etch. The closest cited prior art of Lin et al (US 6,057,207) discloses the step of removing the first nitride layer 44 by chemical mechanical polishing (col 7, lines 39-41)

Response to Arguments

7. Applicant's arguments regarding claims 10-33, 35-42, filed 10/9/2003, have been fully considered but they are not persuasive.

Applicants argue that the examiner's combination does not include claim's 10 and 29 feature of a "first oxide layer disposed above said second nitride layer" because Lin reference does not state that the oxide liner forms over the nitride layer 24/second nitride layer. This argument is unpersuasive because although the examiner recognizes

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that Lin does not explicitly disclose that the oxide liner forms over the nitride layer, Lin discloses the step of forming the trenches 30 through the nitride layer 24/second nitride layer (col 4, lines 45-46, fig. 1) then forming the oxide layer 40 over the layer 24 filling the trenches (col 5, lines 14-16) and forming an oxide liner in the trenches 30 over the substrate surface prior to forming the oxide layer 40 (col 5, lines 20-22). Lin's teaching of forming an oxide liner in the trenches 30 over the substrate surface prior to forming the oxide layer 40, as interpreted by the examiner, reads on the step of forming the first oxide layer disposed above said second nitride layer. Thus, the examiner asserts that the examiner's combination includes claim's 10 and 29 feature of a "first oxide layer disposed above said second nitride layer.

In response to applicant's argument that there is no suggestion to combine the references of Lin and Parat because Lin completely fills his trenches with the oxide layer 40, according there is no reason to deposit Parat's upper oxide layer over Lin's etch barrier layer 44 (silicon nitride) since Lin 's trench 30 already are filled, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, since the motivation to combine Lin and Parat comes from Parat (paragraph 2) , one skilled in the art would

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have found it obvious to incorporate Parat's teaching into Lin method to produce the claimed invention.

It is also argued that Lin does not disclose the feature of "polishing said trench oxide to expose the first nitride layer". This argument is unpersuasive because as seen in fig. 4 of Lin, the nitride layer 44 is exposed by the first CMP to remove a portion of the trench oxide 40.

8. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

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Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 571 272 1471.

The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571 272 1465. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308-0661.



LV

December 28, 2003